इंटरनेट मानक

Disclosure to Promote the Right To Information

Whereas the Parliament of India has set out to provide a practical regime of right to information for citizens to secure access to information under the control of public authorities, in order to promote transparency and accountability in the working of every public authority, and whereas the attached publication of the Bureau of Indian Standards is of particular interest to the public, particularly disadvantaged communities and those engaged in the pursuit of education and knowledge, the attached public safety standard is made available to promote the timely dissemination of this information in an accurate manner to the public.

“जानने का अधिकार, जीने का अधिकार”
Mazdoor Kisan Shakti Sangathan
“The Right to Information, The Right to Live”

“पुराने को छोड नये के तरफ”
Jawaharlal Nehru
“Step Out From the Old to the New”

IS 15191 (2002): Forged Steel Components for Use With Grade T (8) Chain and Chain Slings [MED 14: Cranes, Lifting Chains and Related Equipment]

“ज्ञान से एक नये भारत का निर्माण”
Satyanarayan Gangaram Pitroda
“Invent a New India Using Knowledge”

Act Number 22 of 2005
The Indian Parliament
RIGHT TO INFORMATION

Made Available By
Public.Resource.Org

“ज्ञान एक ऐसा खजाना है जो कभी चुराया नहीं जा सकता है”
Bhartṛhari—Nītiśatakam
“Knowledge is such a treasure which cannot be stolen”

BLANK PAGE

BRUTUM FULMEN

IGNORANTIA
JURIS
NON EXCUSAT

PROTECTED BY COPYRIGHT

*भारतीय मानक*

# ग्रेड टी (8) जंजीर तथा जंजीर सिलंग के साथ उपयोग के लिये गढ़े इस्पात के घटक – विशिष्टि

*Indian Standard*

# FORGED STEEL COMPONENTS FOR USE WITH GRADE T (8) CHAIN AND CHAIN SLINGS — SPECIFICATION

ICS 53.020.30

© BIS 2002

**BUREAU OF INDIAN STANDARDS**
MANAK BHAVAN, 9 BAHADUR SHAH ZAFAR MARG
NEW DELHI 110002

*October* 2002

**Price Group 7**

Cranes and Lifting Chains Sectional Committee, MED 14

## FOREWORD

This Indian Standard was adopted by the Bureau of Indian Standards, after the draft finalized by the Cranes and Lifting Chains Sectional Committee had been approved by the Mechanical Engineering Division Council.

This standard has been formulated to cover the essential requirements of various components employed in chain sling assemblies and chain slings assembled by methods other than welding.

In the preparation of this standard, assistance has been derived from the following publications:

| | |
|---|---|
| ISO 7593 : 1986 | Chain slings assembled by methods other than welding — Grade T (8) |
| ISO 8539 : 1986 | Forged steel lifting components for use with grade T (8) chain |

The composition of the Committee responsible for formulation of this standard is given in Annex B.

For the purpose of deciding whether a particular requirement of this standard is complied with, the final value, observed or calculated, expressing the result of a test or analysis, shall be rounded off in accordance with IS 2 : 1960 'Rules for rounding off numerical values (*revised*)'. The number of significant places retained in the rounded off value should be the same as that of the specified value in this standard.

# *Indian Standard*

# FORGED STEEL COMPONENTS FOR USE WITH GRADE T (8) CHAIN AND CHAIN SLINGS — SPECIFICATION

## 1 SCOPE

**1.1** This standard specifies the requirements for:

a) Forged lifting components for use in chain sling assemblies in a range of sizes having performance compatibility with the corresponding nominal sizes of Grade T (8) chain complying with IS 6215.

b) Method of rating and testing of single, two, three and four branch (leg) chain slings assembled by methods other than welding using Grade T (8) chain conforming to IS 6215 and IS 5616 together with appropriate range of components.

**1.1.1** This standard does not apply to chain slings assembled by welding, to slings designed to have branches of unequal nominal reach, to endless slings, or to slings designed for special applications.

NOTE — Slings having mechanical joining devices on one side and welded components on other is governed by this Indian Standard and IS 2760.

## 2 REFERENCES

The Indian Standards listed below contain provisions which through reference in this text constitute provisions of this standard. At the time of publication, the editions indicated were valid. All standards are subject to revision and parties to agreements based on this standard are encouraged to investigate the possibility of applying the most recent editions of the standards indicated below:

| *IS No.* | *Title* |
|---|---|
| 2760 : 1980 | Steel chain slings (*first revision*) |
| 4748 : 1988 | Method for estimating average grain size of metal (*first revision*) |
| 5616 : 1982 | Short link chain for lifting purposes: General conditions of acceptance (*first revision*) |
| 6215 : 1982 | Short link chain, grade T (8) non-calibrated for lifting purposes (*first revision*) |
| 8324 : 1988 | Code of practice for safe use and maintenance of non-calibrated round steel link lifting chains and chain slings (*first revision*) |

## 3 TERMINOLOGY

For the purpose of this standard, the following definitions shall apply.

**3.1 Chain Sling** — An assembly consisting of chain or chains joined to upper and lower terminal fittings suitable according to the requirements of this standard for attaching loads to be lifted, to the hook of a crane or other lifting machine (*see* Fig. 1 to 4).

**3.2 Master Link** — A link forming the upper terminal fitting of a chain sling by means of which the sling is attached to the hook of a crane or other lifting machines.

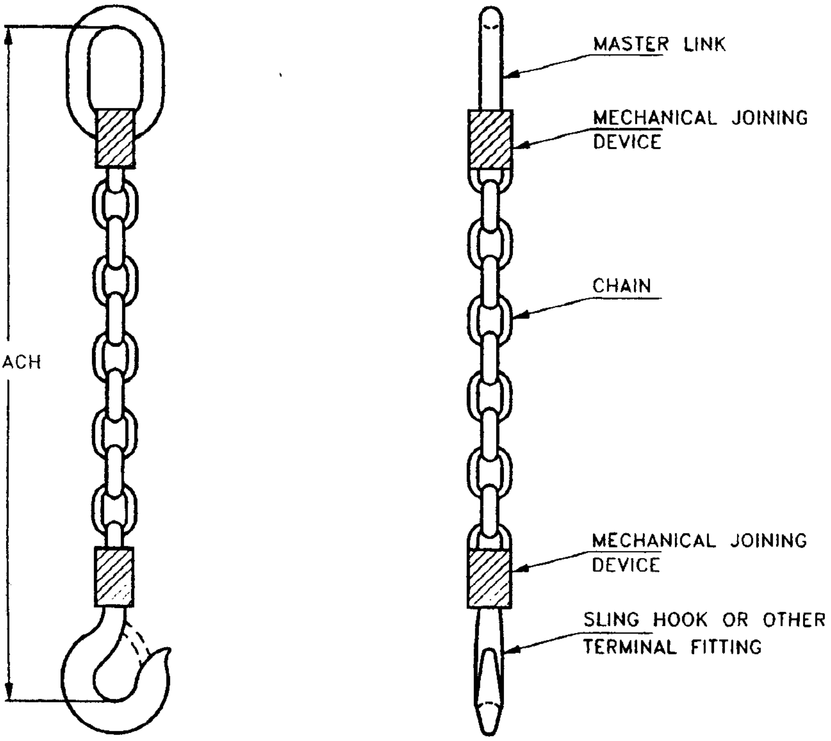
**3.3 Intermediate Master Link** — A link used to connect one or two branches of a sling to a master link (*see* Fig. 3 and 4).

**3.4 Joining Link** — A link fitted to the end of a chain to connect it either directly or through an intermediate link to an upper or lower terminal fitting.

**3.5 Intermediate Link** — A link used to form a connection between the terminal fitting and the joining link fitted to the chain.

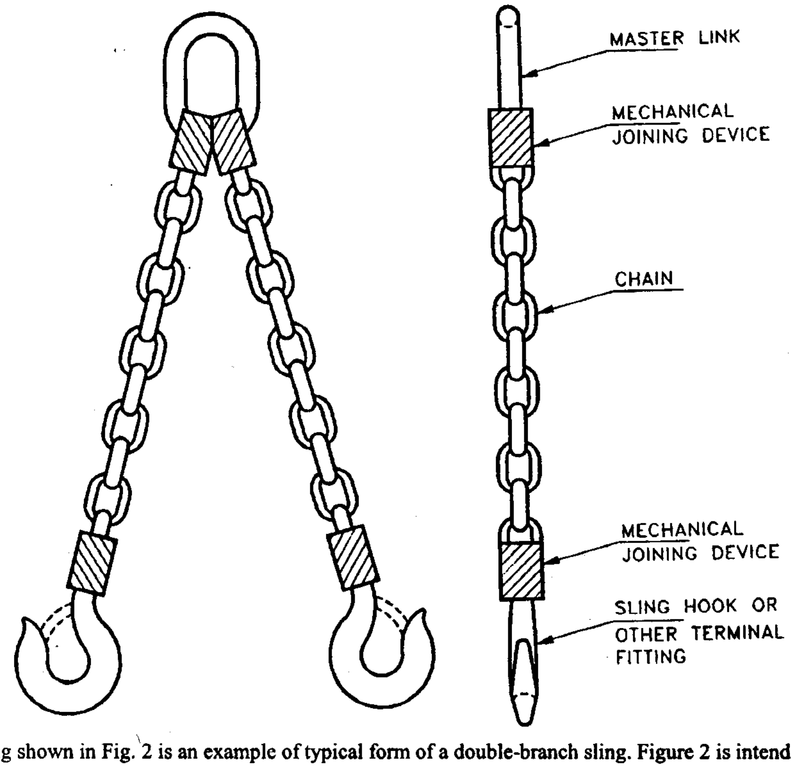
**3.6 Lower Terminal** — A link, hook or other device fitted at the end of a branch remote from the master link or upper terminal.

**3.7 Mechanical Joining Device** — A means of connection, which does not depend on welding, between a chain and another components. It may be integral with the component or be a separate component (*see* Fig. 5).


REACH
MASTER LINK
MECHANICAL JOINING DEVICE
CHAIN
MECHANICAL JOINING DEVICE
SLING HOOK OR OTHER TERMINAL FITTING

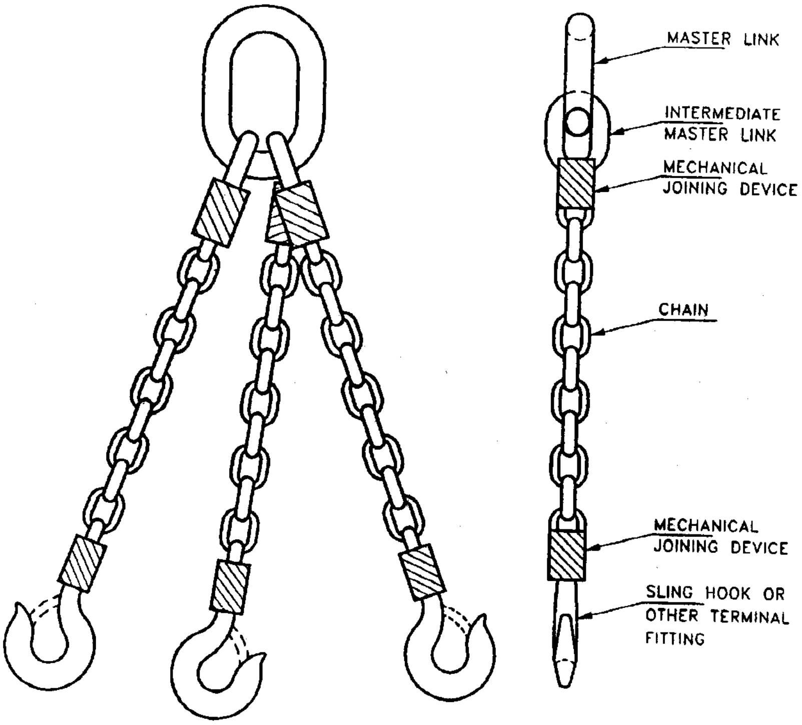
NOTE — The sling shown in Fig.1 is an example of typical form of a single-branch sling. Figure 1 is intended to illustrate the terms, but is not intended to limit the design of the sling.

FIG. 1 SINGLE-BRANCH SLING


MASTER LINK
MECHANICAL JOINING DEVICE
CHAIN
MECHANICAL JOINING DEVICE
SLING HOOK OR OTHER TERMINAL FITTING

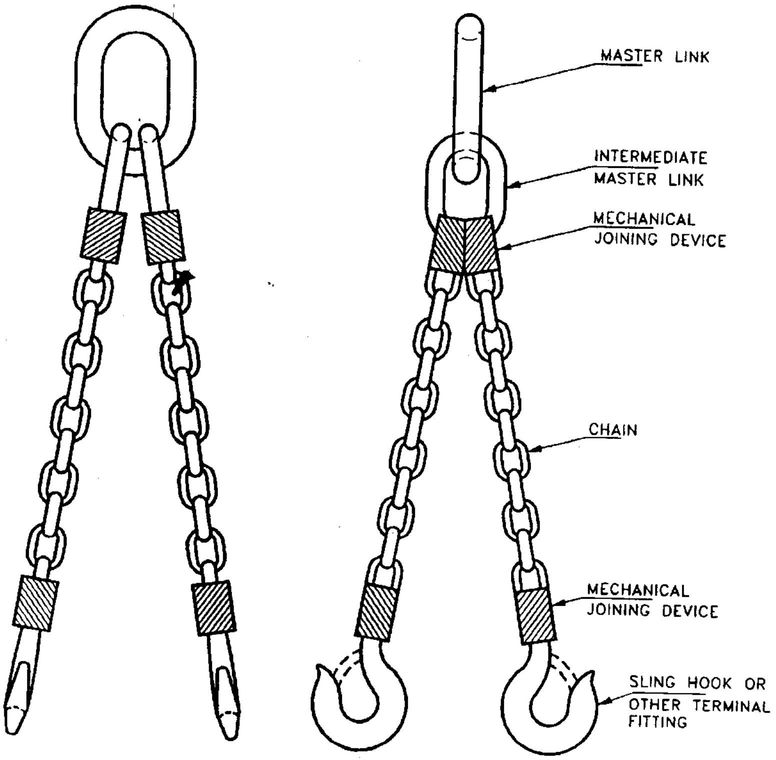
NOTE — The sling shown in Fig. 2 is an example of typical form of a double-branch sling. Figure 2 is intended to illustrate the terms, but is not intended to limit the design of the sling.

FIG. 2 DOUBLE-BRANCH SLING


MASTER LINK
INTERMEDIATE MASTER LINK
MECHANICAL JOINING DEVICE
CHAIN
MECHANICAL JOINING DEVICE
SLING HOOK OR OTHER TERMINAL FITTING

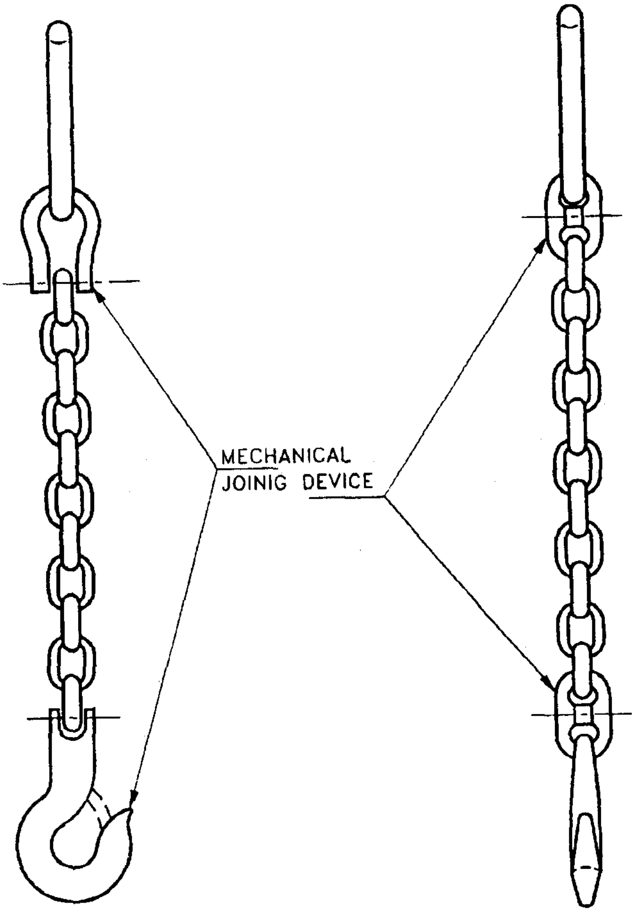
NOTE — The sling in Fig. 3 is an example of typical form of a three-branch sling. Figure 2 is intended to illustrate the terms, but is not intended to limit the design of the sling.

FIG. 3 THREE-BRANCH SLING


MASTER LINK
INTERMEDIATE MASTER LINK
MECHANICAL JOINING DEVICE
CHAIN
MECHANICAL JOINING DEVICE
SLING HOOK OR OTHER TERMINAL FITTING

NOTE — The sling shown in Fig. 4 is an example of typical form of a four-branch sling. Figure 4 is intended to illustrate the terms used, but is not intended to limit the design of the sling.

FIG. 4 FOUR-BRANCH SLING



NOTE — Typical examples of mechanical joining devices are shown in Fig. 5, the examples illustrated are not intended to limit the design of mechanical joining devices.

FIG. 5 MECHANICAL JOINING DEVICES

**3.8 Proof Force** — A force applied as a test to the whole sling or a force applied as a test to a section of sling (*see* **12**).

**3.9 Working Load Limit ($W_{LL}$)** — The maximum mass at which a sling is designed to support in general service.

**3.10 Working Load ($W_L$)** — The maximum mass at which a sling should be used to support in a particular stated service.

**3.11 Competent Person** — The person who is approved and declared as such under the relevant statutory provisions.

**3.12 Inspector** — Representative of purchaser.

## 4 DESIGNATIONS

**4.1** The following designations shall be used in specifying slings to this standard.

**4.1.1** *Nominal Size*

It is the nominal size of the short link chain used in its manufacture.

**4.1.2** *Nominal Reach of Sling*

The reach of a branch of the finished sling is the effective length from the inside of the lower terminal fitting to the inside of the upper terminal fitting (*see* Fig. 1).

**4.1.3** *Grade of Sling*

The nominal grade of a sling, for the purpose of its designation shall be the same as the grade of the chain used, that is, T (8) (*see* **6**).

## 5 DESIGN AND CONSTRUCTION

**5.1** Some examples of chain sling configurations complying with this standard are shown in Fig. 1 to 4.

**5.2** Egg or pear shaped links, that is, those having difficult radius at either end, shall not be used as master links or as lower terminals.

**5.3** The system shall be so designed and manufactured that when assembled in accordance with the system manufacturer's instructions, the unintentional disconnections of any of its component parts shall not occur.

## 6 DIMENSIONS, TOLERANCES AND MECHANICAL PROPERTIES

**6.1** The dimensions and tolerances of the chain shall be in accordance with IS 6215.

### 6.2 Master Links and Intermediate Master Links

**6.2.1** The inside dimensions and the section of the material shall be such that:

a) master link fits on Grade M (4) hook two sizes larger than the sling and fits into a Grade T (8) hook of the same rating as the sling.

b) the inside width of the master link shall not be not less than one to two times the maximum width ($L_n$) of the Grade M (4) hook section defined in **6.2.1**(a).

c) for slings with hooks as lower terminals, unless another means of securing the hooks when not loaded is provided, the inside dimensions and the section are such as to allow the lower terminal to be hooked into the master link while it is on a hook as defined in **6.2.1**(a).

**6.2.2** Master links and intermediate master links may be of round or other suitable section but the section of the material shall be closed so that:

a) after proof loading (*see* **12**) the master link and intermediate master links do not show any significant permanent deformation.

b) the total ultimate elongation shall be at least 17 percent.

c) the minimum breaking force shall be twice the proof force (*see* **12**).

### 6.3 Lower Terminal Links

**6.3.1** The dimensions of the lower terminal links shall be such as to ensure free articulation of the links.

**6.3.2** The section of the material shall be such that:

a) after proof loading (*see* **12**) the lower terminal links do not show any significant permanent deformation.

b) the total ultimate elongation shall be at least 17 percent.

c) the minimum breaking force shall be twice the proof force (*see* **12**).

NOTE — This value does not apply to forged links having internal mechanical joining devices. However, in such cases sufficient elongation should be achieved to demonstrate the ductility of the links.

### 6.4 Mechanical Joining Device

The assembled mechanical joining device shall have load carrying capabilities not less than those of the chains; with which it is connected in a sling assembly. Load carrying capabilities include, for example, working load limit proof force and minimum ultimate breaking force.

### 6.5 Other Components

The dimension of the components shall be such as to ensure sufficient articulation so that the load may be transmitted axially.

### 6.6 Tolerances on Reach

**6.6.1** When constructing the sling, the actual reach of each branch shall be nominal reach ordered by a purchaser $\begin{smallmatrix}+2\\-0\end{smallmatrix}$ chain link pitches.

**6.6.2** When constructing a multi-branch sling, the difference in reach between the longest and shortest branches when measured under equivalent tension shall not exceed 6 mm for nominal reaches up to 2 m, for nominal reaches in excess of 2 m the tolerances may be increased by 3 mm/m.

### 6.7 Mechanical Properties

**6.7.1** *General*

The mechanical properties of load-bearing components shall be as specified in Table 1 in which the properties are related to the nominal size of the chain.

**6.7.2** *Proof Force*

Each component, including load-bearing pins, if any, tested in accordance with **9.2** shall be capable of sustaining the proof force specified in Table 1 without significant permanent deformation.

**6.7.3** *Ultimate Strength*

Each component, including load-bearing pins, if any, tested in accordance with **9.3** shall have an ultimate strength at least equal to that specified in Table 1. On completion of test the component shall show evidence of ductility.

### 6.7.4 *Fatigue Resistance*

Components, including load-bearing pins, if any, with a working load limit of up to and including 10 t, when tested in accordance with **9.4**, shall be capable of retaining the load after at least 10 000 cycles.

**Table 1 Mechanical Properties of Components**
(*Clauses* 6.7.1, 6.7.2, 6.7.3, 9.2, 9.3 *and* 9.4)

| **Nominal Size of Chain** | **Working Load Limit ($W_{LL}$)** | **Proof Force** | **Minimum Ultimate Strength** |
|---|---|---|---|
| Nom Dia $d_n$ in mm | t | kN | kN |
| (1) | (2) | (3) | (4) |
| 6 | 1.1 | 22.7 | 45.4 |
| 7 | 1.6 | 30.3 | 61.6 |
| 8 | 2.0 | 40.3 | 80.6 |
| 10 | 3.2 | 63 | 126 |
| 13 | 5.4 | 107 | 214 |
| 16 | 8.0 | 161 | 322 |
| 18 | 10 | 204 | 408 |
| 19 | 11.5 | 227 | 454 |
| 20 | 12.5 | 252 | 504 |
| 22 | 15.5 | 305 | 610 |
| 23 | 16.9 | 333 | 666 |
| 25 | 20 | 393 | 786 |
| 26 | 21.6 | 425 | 850 |
| 28 | 25 | 493 | 936 |
| 32 | 32 | 644 | 1 288 |
| 36 | 40 | 815 | 1 530 |
| 40 | 50 | 1 006 | 2 012 |
| 45 | 63 | 1 273 | 2 546 |

NOTES (BASIS FOR CALCULATION)

1 The value of $W_{LL}$ are derived from the full calculated values for the chain (*see* Annex A).

2 The proof force values are half the minimum ultimate strength values.

3 The minimum ultimate strength values are calculated from the following and the value to be rounded up to the nearest 0.2 below 100 kN and up to the nearest whole even number above 100 kN:

$$500 \times \frac{\pi d_n^2}{2} N$$

4 With the values given in the table, the ratios 1 : 2 : 4 are ensured, the mean stress at $W_{LL}$ is never quite attained and the mean stress at proof force and ultimate strength are all slightly exceeded.

## 7 MATERIALS AND HEAT TREATMENT

**7.0** The material and heat treatment used in the manufacture of load bearing components shall comply with the following.

**7.1** Chain shall comply with the requirement of IS 6215.

**7.2** Components which are covered by relevant standards shall comply with the requirements of those standards.

**7.3** Components for use with T (8) chain which are not covered by standards shall comply with the material requirements specified in **7.3.1** and **7.3.2**.

### 7.3.1 *Quality of Material*

The steel shall be produced by the open hearth or electric process or by oxygen blown process and shall possess reliable forging quality. In its finished state as supplied to the components manufacturer it shall meet the following requirements as determined by check analysis on the billet, bar or finished component:

a) It shall be fully killed and shall contain alloying elements in sufficient quantities to guarantee the mechanical properties of the component after appropriate heat treatment, the alloy steel used shall contain at least two of the alloying elements like nickel; chromium; and molybdenum.

Its contents of sulphur and phosphorus shall be restricted as follows:

|  | *Cast Analysis* | *Check Analysis* |
|---|---|---|
| Sulphur, *Max* | 0.035% | 0.040 % |
| Phosphorus, *Max* | 0.035% | 0.040% |

b) The steel shall be made in conformity with fine grain practice to give an austenic grain size of five or finer when tested in accordance with IS 4748. This could be accomplished, for example, by ensuring that it contains sufficient aluminium or an equivalent element to permit the manufacture of components stabilized against strain age embrittlement during service; a minimum value of 0.02 percent metallic aluminium is recommended.

Within the above limitations it is the responsibility of the component manufacturer to select so that the finished component, suitably heat treated, meets the mechanical properties specified in this standard.

### 7.3.2 *Heat Treatment*

These components before proof loading, shall be heat treated in such a way to achieve the required mechanical and metallurgical properties. Components can be used up to a maximum temperature of 400°C (*see* **3.3.1** of IS 8324) without impairment or change to these metallurgical and mechanical properties when returned to room temperature. When requested, for variation, sample components shall be tested following reheating to 400°C, holding for one hour and cooling to room temperature.

## 8 MANUFACTURING METHODS AND WORKMANSHIP

**8.1 Master Links, Intermediate Master Links and Lower Terminals** — These components shall be forged, or formed and welded. If welded they shall conform to **9** of IS 2760.

**8.2** Each forged item of a component shall be forged in one piece. After heat treatment, furnace scale shall be removed and the components shall be free from harmful surface defects, including cracks. The use of welding at any stage in manufacture is not permitted.

**8.3 Manufacturing Test Force** — In the course of manufacturing, the heat-treated components, other than chain, shall be subjected to a force at least equal to the proof force specified in **12**. Chain complying with IS 6215 shall be subjected to a force of at least 50 percent of the minimum breaking force.

**8.4 Assembly** — The assembly of the sling should only be undertaken by persons (*see* **3.11**) acting in accordance with the chain and component manufacturer's instructions.

**8.5 Test Data** — Upon request to prove design, the chain or component manufacturer shall supply test data representing an actual test on any component, equivalent to that supplied.

## 9 TYPE TEST FOR FORGED COMPONENTS

### 9.1 General

The type tests demonstrate that components certified by the manufacturer as complying with the requirements laid down in this standard possess mechanical properties specified in this standard. The purpose of these tests is to prove the design, material, heat treatment and method of manufacture of each size of finished component. Any change in design, material specification, heat treatment, method of manufacture or in any dimension outside normal manufacturing tolerances which may lead to a modification of the mechanical properties defined in **6.7** shall require that the type tests specified in **9.2** to **9.4** be carried out on the modified components.

All components to be type tested shall comply with all the other requirements laid down in this standard. The tests specified in **9.2** to **9.4** shall be carried out on each size of component of each design, material, heat treatment and method of manufacture.

In the test specified in **9.2** to **9.4** the force shall be applied to the component axially without shock.

### 9.2 Deformation Test

Three samples shall be tested and each shall be capable of sustaining the proof force specified for the component in Table 1 without significant permanent deformation.

NOTE — *See* also **12** for proof testing of all components.

### 9.3 Static Strength Test

Three samples shall be tested and each shall have an ultimate strength at least equal to the minimum value specified for the component in Table 1.

It is not necessary to test the component up to its actual ultimate strength for the mechanical properties specified to be demonstrated. It is sufficient that the minimum ultimate strength specified is reached and that the component shows evidence of ductility.

NOTE — This test may be carried out on the same components that have been submitted to the deformation test.

### 9.4 Fatigue Test

Components with a working load limit of up to and including 10 t shall be subjected to the fatigue test. Three samples shall be tested for conformity.

The force range applied during each cycle shall be equal to 0.75 times the proof force specified in Table 1 for the component. The minimum force in each cycle shall be positive and less than or equal to 3 kN. The frequency of force application shall be between 5 and 25 Hz. The samples tested shall be capable of sustaining at least 10 000 cycles of the force range specified above without failing to retain the load.

### 9.5 Acceptance Criteria for Type Testing

**9.5.1** *Deformation Test* (*see* **9.2**)

All three samples tested shall pass the deformation test in order for the component of the size submitted for type testing to comply with this standard.

**9.5.2** *Static Strength Test and Fatigue Test* (*see* **9.3** and **9.4**)

If all three samples pass the test, the component of the size submitted for type testing complies with this standard.

If one of the samples fails, two further samples shall be tested and both shall pass the test in order for the component of the size submitted for type testing to comply with this standard.

If two or three samples fail the test, the component of the size submitted for type testing does not comply with this standard.

## 10 FINAL EXAMINATION

Following completion of the assembly of the sling, the sling shall be:

a) subjected to the proof force test in accordance with **12** and subsequently examined by a competent person (*see* **12.1.2**), or

b) in other cases the sling shall be visually examined by a competent person to ensure freedom from defects provided that each component has been certified as having been tested with a force at least equal to the manufacturer's test force (*see* **8.3**).

## 11 RATING

### 11.1 Single-Branch Slings

Single-branch slings shall be rated at a working load limit equal to that of the chain used in their construction.

### 11.2 Multi-Branch Slings

There are two alternative methods of rating multi-branch-slings:

a) *Uniform load method* (see *Table* 2) — The slings are rated at a uniform working load limit for any angle between braches of 0° to 90° (0° to 45° to the vertical) or additionally at a uniform working load limit for any angle between branches of 90° to 120° (45° to 60° to the vertical).

b) *Trigonometric method* (see *Table* 3) — The slings are rated at a working load limit according to the particular angle between branches at which the sling is to be employed; for this purpose reference is usually made to trigonometric tables.

**11.2.1** *Uniform Load Method*

a) *Double branch slings* — For all angles between branches from 0° to 90° (0° to 45° to the vertical)

$W_{LL} = 1.4 \times W_{LL}$ of a single branch

When additionally marked for angles between branches of 90° to 120° (45° to 60° to the vertical) the working load limit ($W_{LL}$) is given by the formula:

$W_{LL} = 1 \times W_{LL}$ of a single branch

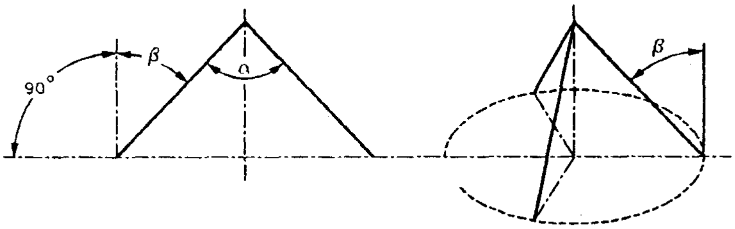
b) *Three and four branch slings* — For all angles between branches from 0° to 90° (0° to 45° to the vertical) the working load limit ($W_{LL}$) is given by the formula:

$W_{LL} = 2.1 \times W_{LL}$ of a single branch

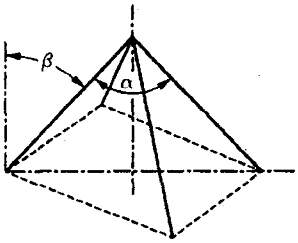
When additionally marked for angles between branches of 90° to 120° (45° to 60° to the vertical) the working load limit ($W_{LL}$) is given by the formula:

$W_{LL} = 1.5 \times W_{LL}$ of a single branch

NOTE — In the case of a three-branch sling the angle between branches shall be taken as twice the angle to the vertical, that is 2 × β (*see* Fig. 6). In the case of a four-branch sling, the angle between branches shall be that between diagonally opposite branches.



a) TWO BRANCHES b) THREE BRANCHES



c) FOUR BRANCHES

FIG. 6 INCLINATION OF SLING-BRANCH (*see* TABLES 2 AND 3)

### 11.2.2 *Trigonometric Method*

a) *Double-Branch Slings*

The working load limit ($W_{LL}$) for double-branch sling is given by the formula:

$$W_{LL} = 2 \times W_{LL} \text{ of a single branch} \times \cos\beta$$

b) *Three- and Four-Branch Slings*

The working load limit ($W_{LL}$) for double branch sling is given by the formula:

$$W_{LL} = 2 \times W_{LL} \text{ of a single branch} \times \cos\beta$$

NOTE — In the case of a four-branch sling, if proper measures are taken to achieve the equal distribution of the load between each branch, all four branches can be considered as supporting the load. The rating of a four-branch sling may, in such circumstances, be based on the formula:

$$W_{LL} = 4 \times W_{LL} \text{ of a single branch} \times \cos\beta$$

### 11.3 Nominal Rating

Unless otherwise specified the nominal rating of any multi-branch sling whether rated by the uniform load or trigonometric method shall be the $W_{LL}$ for that sling when used at an angle of 90° between the branches (45° to vertical).

NOTE — A master link designed for use in a sling rated by the uniform load method is not necessarily suitable for use in a sling rated by the trigonometric method.

## 12 PROOF FORCE

**12.1** When required under **10.1**(a) assembled slings with accessories shall be subjected to a proof force test. Multi-branch slings shall be tested in sections. Each individual section shall be subjected to a force equivalent to twice its working load limit, in accordance with the following plan.

### 12.2 Proof Force Factors

Sections of sling assemblies shall be subjected to proof forces in kN equivalent to loads calculated by multiplying the working load limit of the relevant chain size, by the factors below :

*Factors for Uniform Load Method*

| Section (*see* Fig. 7) | $PL_1$ | $PL_2$ | $PL_3$ | $PL_4$ |
|---|---|---|---|---|
| Working load limit | 1.0 | 1.4 | 1.6 | 2.1 |
| Proof force ($2 \times W_{LL}$) | 2.0 | 2.8 | 3.2 | 4.2 |

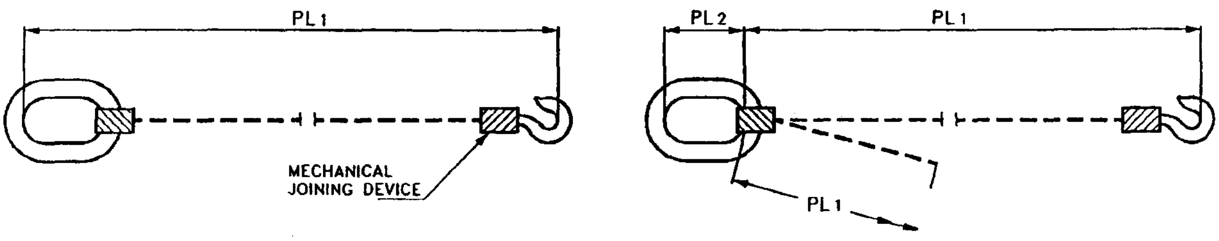
*Factors for Trigonometric Method*

| Section (*see* Fig. 7) | $PL_1$ | $PL_2$ | $PL_3$ | $PL_4$ |
|---|---|---|---|---|
| Working load limit | 1.0 | 2.0 | 2.0 | 3.0<br>(*see* Note 1) |
| Proof force ($2 \times W_{LL}$) | 2.0 | 4.0 | 4.0 | 6.0<br>(*see* Note 2) |

NOTES

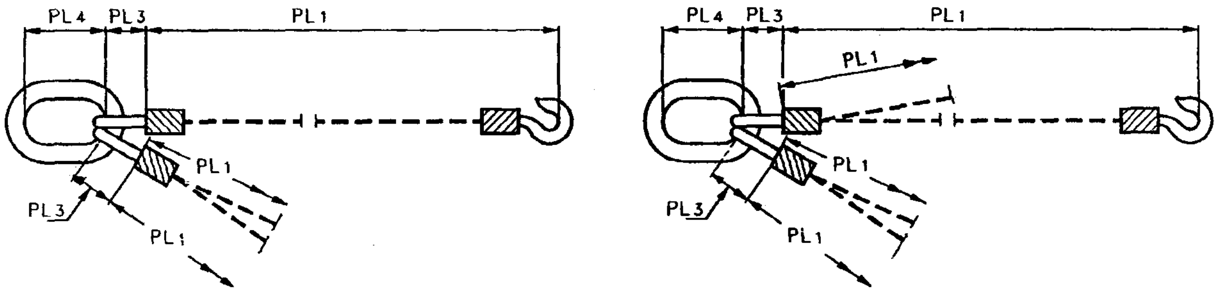
1 If a four-sling is rated in accordance with the Note under **11.2.2(b)**, the factor for $PL_4 = 4.0$.

2 If a four-branch sling is rated in accordance with the Note under **11.2.2(b)**, the factor for $PL_4 = 8.0$.



a) SINGLE - BRANCH SLING

b) DOUBLE - BRANCH SLING



c) THREE - BRANCH SLING

d) FOUR - BRANCH SLING

FIG. 7 SECTIONS OF SLINGS TO WHICH PROOF FORCE SHALL BE APPLIED

**12.2.1** After completion of the proof loading when required under **10.1**(a) and removal of the force, the sling shall be carefully examined by a competent person. Any faulty chain or component shall be replaced, and the sling retested and examined.

## 13 MARKING

**13.1** The following information shall be shown on a metal tag or label permanently attached to the master link or to a link immediately adjacent to it. Alternatively all or part of the information may be marked on the master link provided the mechanical properties of the link are not significantly impaired.

a) *For Single-Branch Sling:*

   i) Working load limit (kg or t);
   ii) Individual identification number or symbols (related to the certificate);
   iii) Grade T (8);
   iv) Assembler's name or symbol;
   v) Size of chain (optional); and
   vi) Year of manufacture.

b) *For Slings Rated Uniformly for Use with Angles from 0° to 90° Between Branches (0° to 45° to the Vertical):*

   i) The working load limit, as $W_{LL}$ (kg or t) 0° to 90° (0° to 45° to the vertical);
   ii) Individual identification number or symbol (related to the certificate);
   iii) Grade T (8);
   iv) Assembler's name or symbol;
   v) Size of chain (optional);
   vi) Number of branches; and
   vii) Additionally there may be a mark on the tag or label or on a separate tag or label attached in a similar manner, the working load limit applicable for use at 90° to 120° (45° to 60° to the vertical), as $W_{LL}$ (kg or t) 90° to 120° (45° to 60° to the vertical).

c) *For Slings Rated for Use with Trigonometrically Tables:*

   i) The working load limit, as 90° between the branches (45° to the vertical), as $W_{LL}$ (in kg or t) at 90° (45° to the vertical);
   ii) Individual identification number or symbol (related to the certificate);
   iii) Grade T (8);
   iv) Assembler's name or symbol;
   v) Size of chain (optional); and
   vi) Number of branches.

**13.1.1** If a tag or label described in **13.1**(a), (b) or (c) become detached, the chain sling may be used only in accordance with the rating shown on a remaining tag or label. If no tag or label remains, the chain sling should be taken out of service, unless the necessary information is marked on the master link itself.

### 13.2 BIS Certification Marking

The chain slings may also be marked with the Standard Mark.

**13.2.1** The use of the Standard Mark is governed by the provisions of *Bureau of Indian Standards Act*, 1986 and the Rules and Regulations made thereunder. The details of conditions under which the license for the use of Standard Mark may be granted to manufacturers or producers may be obtained from the Bureau of Indian Standards.

## 14 CERTIFICATE

**14.1** Each sling shall be provided with a dated certificate giving the following information:

a) Name of sling manufacturer, assemblers or supplier;
b) Identification number or symbol (*see* **13**);
c) Configuration of sling (*see* **5**);
d) Size of chain and grade mark T (8);
e) Nominal reach;
f) Working load limit ($W_{LL}$);
g) Working load where stated service demands;
h) A statement that the sling components in the course of manufacture, where subjected to the manufacturing test force (*see* **8.3**);
j) In the case of slings 'proof tested' following assembly (*see* **10.1**) the certificate shall include the following information:
   i) Name of person or establishment, which carried out the proof test and final examination, and
   ii) Value of proof force(s) applied;
k) In the case of slings 'not proof tested' after assembly (*see* **10.1**) the certificate shall include the name of person or establishment which carried out the visual examination.

## Table 2 Calculated Working Load Limits — Uniform Load Method of Rating

[*Clause* 11.2(a), and *Fig.* 6, and *Annex A*]

| Chain Branch | Single-Slings | Double-Branch Sling | | Three- and Four-Branch Slings Size | |
|---|---|---|---|---|---|
| | | $0° \leq \alpha \leq 90°$<br>$0° \leq \beta \leq 45°$ | $90° \leq \alpha \leq 120°$<br>$45° \leq \beta \leq 60°$ | $0° \leq \alpha \leq 90°$<br>$0° \leq \beta \leq 45°$ | $90° \leq \alpha \leq 120°$<br>$45° \leq \beta \leq 60°$ |
| mm | t | t | t | t | t |
| (1) | (2) | (3) | (4) | (5) | (6) |
| 6 | 1.1 | 1.5 | 1.1 | 2.3 | 1.6 |
| 7 | 1.5 | 2.1 | 1.5 | 3.1 | 2.2 |
| 8 | 2.0 | 2.8 | 2.0 | 4.2 | 3.0 |
| 10 | 3.2 | 4.4 | 3.2 | 6.7 | 4.8 |
| 12 | 4.6 | 6.4 | 4.6 | 9.6 | 6.9 |
| 1)13 | 5.4 | 7.5 | 5.4 | 11.3 | 8.1 |
| 14 | 6.3 | 8.8 | 6.3 | 13.2 | 9.4 |
| 16 | 8.0 | 11.2 | 8.0 | 16.8 | 12.0 |
| 18 | 10.0 | 14.0 | 10.0 | 21.0 | 15.0 |
| 19 | 11.5 | 16.1 | 11.5 | 24.1 | 17.2 |
| 20 | 12.5 | 17.5 | 12.5 | 26.2 | 18.6 |
| 22 | 15.5 | 21.7 | 15.5 | 32.5 | 23.2 |
| 1)23 | 16.9 | 23.6 | 16.9 | 35.4 | 25.3 |
| 25 | 20.0 | 28.0 | 20.0 | 42.0 | 30.0 |
| 1)26 | 21.6 | 30.2 | 21.6 | 45.3 | 32.4 |
| 28 | 25.0 | 35.0 | 25.0 | 52.5 | 37.5 |
| 32 | 32.0 | 44.8 | 32.0 | 67.2 | 48.0 |
| 36 | 40.0 | 56.0 | 40.0 | 84.0 | 60.0 |
| 40 | 50.0 | 70.0 | 50.0 | 105.0 | 75.0 |
| 45 | 63.0 | 88.2 | 63.0 | 132.3 | 94.5 |

NOTES

1 The value of $W_{LL}$ for a single leg sling (col 2) are derived from the full calculated values (*see* Annex A).

2 The value of $W_{LL}$ for multi-branch slings are calculated from the values of col 2 multiplied by the appropriate factors specified in **11.2.1** and rounded down to one place of decimals.

1)These sizes are non-preferred. These sizes may be supplied subject to agreement between the manufacturers and purchasers.

## Table 3 Calculated Working Load Limits — Trigonometric Method of Rating

[*Clause* 11.2(b), and *Fig.* 6, and *Annex A*]

| Chain Size Slings mm | Single-Branch | Double-Branch Slings | | | | | Three- and Four-Branch Slings | | |
|---|---|---|---|---|---|---|---|---|---|
| | | α=30° β=15° t | α=60° β=30° t | α=90° β=45° t | α=120° β=60° t | α=30° β=15° t | α=60° β=30° t | α=90° β=45° t | α=120° β=60° t |
| (1) | (2) | (3) | (4) | (5) | (6) | (7) | (8) | (9) | (10) |
| 6 | 1.1 | 2.1 | 1.9 | 1.5 | 1.1 | 3.1 | 2.8 | 2.3 | 1.6 |
| 7 | 1.5 | 2.8 | 2.5 | 2.1 | 1.5 | 4.8 | 3.8 | 3.1 | 2.2 |
| 8 | 2.0 | 3.8 | 3.4 | 2.8 | 2.0 | 5.7 | 5.1 | 4.2 | 3.0 |
| 10 | 3.2 | 6.1 | 5.5 | 4.5 | 3.2 | 9.2 | 8.3 | 6.7 | 4.8 |
| 12 | 4.6 | 8.8 | 7.9 | 6.5 | 4.6 | 13.3 | 11.9 | 9.7 | 6.9 |
| 1)13 | 5.4 | 10.4 | 9.3 | 7.6 | 5.4 | 15.6 | 14.0 | 11.4 | 8.1 |
| 14 | 6.3 | 12.1 | 10.9 | 8.9 | 6.3 | 18.2 | 16.3 | 13.3 | 9.4 |
| 16 | 8.0 | 15.4 | 13.8 | 11.3 | 8.0 | 23.1 | 20.7 | 16.9 | 12.0 |
| 18 | 10.0 | 19.3 | 17.3 | 14.1 | 10.0 | 28.9 | 28.9 | 21.2 | 15.0 |
| 1)19 | 11.5 | 22.2 | 19.9 | 16.2 | 11.5 | 33.3 | 29.8 | 24.3 | 17.2 |
| 20 | 12.5 | 21.1 | 21.6 | 17.6 | 12.5 | 36.2 | 32.4 | 26.5 | 18.7 |
| 22 | 15.5 | 29.9 | 26.8 | 21.9 | 15.5 | 44.9 | 40.2 | 32.8 | 23.2 |
| 1)23 | 16.9 | 32.6 | 29.2 | 23.9 | 16.9 | 48.9 | 43.9 | 35.8 | 25.3 |
| 25 | 20.0 | 38.9 | 34.6 | 28.2 | 20.0 | 57.9 | 51.9 | 42.4 | 30.0 |
| 1)26 | 21.6 | 41.7 | 37.4 | 30.5 | 21.6 | 62.5 | 56.1 | 45.8 | 35.1 |
| 28 | 25.0 | 48.2 | 43.3 | 35.3 | 25.0 | 72.4 | 64.9 | 53.0 | 37.5 |
| 32 | 32.0 | 61.8 | 55.4 | 45.2 | 32.0 | 92.7 | 83.1 | 67.8 | 48.0 |
| 36 | 40.0 | 77.2 | 69.2 | 56.5 | 40.0 | 115.9 | 103.9 | 84.8 | 60.0 |
| 40 | 50.0 | 96.5 | 86.6 | 70.7 | 50.0 | 144.8 | 129.9 | 106.0 | 75.0 |
| 45 | 63.0 | 121.7 | 109.1 | 89.6 | 63.0 | 182.5 | 163.6 | 133.6 | 94.3 |

NOTES

1 The values of $W_{LL}$ for a single leg sling (col 2) are derived from the full calculated values (*see* Annex A).

2 The values of $W_{LL}$ for multi-branch slings are calculated from the values of col 2 multiplied by the appropriate factors specified in **11.2.1** and rounded down to one place of decimals.

3 Attention is drawn to the Note of **11.2.2** permitting the higher rating of four-branch slings in certain circumstances. These values have not been included in the table.

1)These sizes are non-preferred. These sizes may be supplied subject to agreement between the manufacturers and purchasers.

# ANNEX A

*[Tables* 1 *and* 2 *(Note* 1)]

## CALCULATED VALUES OF WORKING LOAD LIMIT ($W_{LL}$)

| **Nominal Size of Chain** | **Full Caculated Working Load Limit ($W_{LL}$)** | **Working Load Limits as ($W_{LL}$) Specified in Tables 2 and 3** |
|---|---|---|
| Nom Dia $d_n$ in mm | t | t |
| 6 | 1.153 27 | 1.1 |
| 7 | 1.569 73 | 1.5 |
| 8 | 2.050 26 | 2.0 |
| 10 | 3.203 53 | 3.2 |
| 12 | 4.613 0 875 | 4.6 |
| 1)13 | 5.413 97 | 5.4 |
| 14 | 6.278 9 246 8 | 6.3 |
| 16 | 8.201 04 | 8.0* |
| 18 | 10.379 45 | 10.0* |
| 1)19 | 11.561 75 | 11.5 |
| 20 | 12.814 13 | 12.5* |
| 22 | 15.505 10 | 15.5 |
| 1)23 | 16.946 69 | 16.9 |
| 25 | 20.022 08 | 20.0 |
| 1)26 | 21.655 88 | 21.6 |
| 28 | 25.115 70 | 25.0* |
| 32 | 32.804 18 | 30.0* |
| 36 | 41.517 79 | 40.0* |
| 40 | 51.256 53 | 50.0* |
| 45 | 64.871 54 | 63.0* |

NOTES

1 The values for full calculated $W_{LL}$ have been determined using the following formulae:

$$\frac{200 \pi d_n^2}{2} \text{ N or } 0.032\,036\,33\, d_n^2 \text{ tonnes (t).}$$

2 The values for $W_{LL}$ as specified in Tables 2 and 3 and given in the table above have been derived from the full calculated values, rounded down to one place of decimals, except for those marked with '*' which have been rounded down to the nearest preferred number, because the nominal sizes of the chain are also preferred numbers.

1)These sizes are non-preferred. These sizes may be supplied subject to agreement between the manufacturers and purchasers.

# ANNEX A

## (*Foreword*)

## COMMITTEE COMPOSITION

### Cranes and Lifting Chains Sectional Committee, MED 14

| *Organization* | *Representative(s)* |
|---|---|
| Bharat Heavy Electricals Ltd, Tiruchirappalli | Shri K. Manickam (***Chairman***) |
| Armsel Met Pvt Ltd, Bangalore | Shri A. C. Heri<br>Shri N. Vasudeva (*Alternate*) |
| Auri Industries India (P) Ltd, Pune | Shri M. N. Dantwala |
| Bharat Heavy Electricals Ltd, Hyderabad | Shri Girish Shrivastava<br>Shri M. Subba Rao (*Alternate*) |
| Bhartiya Cutler-Hammer, Faridabad | Shri V. Ramachandran<br>Shri Virender Singh (*Alternate*) |
| Braithwaite & Co Ltd, Kolkata | Shri S. K. Gangopadhyay<br>Shri A. P. Saha (*Alternate*) |
| Central Building Research Institute, Roorkee | Shri R. L. Gupta<br>Shri D. K. Gautam (*Alternate*) |
| Coal India Ltd, Kolkata | Shri R. Dasgupta |
| Directorate General Factory Advice Service & Labour Institute, Mumbai | Shri M. A. Balakrishnan<br>Shri G. M. K. Raj (*Alternate*) |
| Directorate General of Suppplies & Disposals, New Delhi | Shri R. C. Gupta<br>Shri J. K. Khanna (*Alternate*) |
| Escorts Construction Equipment Ltd, Faridabad | Shri Pradeep K. Tyagi<br>Shri Ravindra Luthra (*Alternate*) |
| Furnance and Foundry Equipment Co, Mumbai | Shri Shyam M. Gurnani |
| Hercules Hoists Ltd, Mumbai | Shri P. B. Kucheria<br>Shri H. A. Nevatia (*Alternate*) |
| Hindustan Shipyard Ltd, Visakhapatnam | Shri D. V. S. N. Raju<br>Shri B. Krishnappa (*Alternate*) |
| Indian Chain Pvt Ltd, Kolkata | Shri P. Chitlangia<br>Shri Lalitmohan (*Alternate*) |
| Indian Link Chain Manufacturers Ltd, Mumbai | Shri P. K. Nevatia |
| Jessop & Co Ltd, Kolkata | Shri Bimal Chandrapal<br>Shri Tapan Datta (*Alternate*) |
| Larsen & Toubro Limited, Kolkata | Shri M. S. Chakraborthy<br>Shri L. N. Mishra (*Alternate*) |
| Lifting Equipment and Accessories Ltd, Delhi | Shri Rajiv Khetan |
| Mega Drives Pvt Ltd, Thane | Shri Majumdar<br>Shri N. B. Bhujle (*Alternate*) |
| Metallurgical & Engg. Consultants (I) Ltd, Ranchi | Shri T. K. Roy<br>Shri H. S. Singh (*Alternate*) |
| M.N. Dastur & Co Ltd, Kolkata | Shri D. Ghosh<br>Shri G. C. Banerjee (*Alternate*) |
| Ministry of Defence (DGI), New Delhi | Shri K. Parthiban<br>Shri Rajinder Singh (*Alternate*) |
| Ministry of Surface Transport, New Delhi | Shri T. K. Datta |
| Mukand Ltd, Thane | Shri D. Chakraborthy<br>Shri D. S. Senthilvel (*Alternate*) |
| National Thermal Power Corpn Ltd, New Delhi | Shri B. K. Bhattacharya<br>Shri R. S. Yadav (*Alternate*) |
| Project and Development India Ltd, Dhanbad | Shri L. C. Dadlani<br>Shri R. N. Prasad (*Alternate*) |
| Research, Designs & Standards Organization, Lucknow | Shri R. N. Haldar |
| Reva Engg. Industrial (P) Ltd, New Delhi | Shri Balraj Goel<br>Shri R. K. Gandhi (*Alternate*) |
| Southern Structural Ltd, Chennai | Shri J. Kumaran<br>Shri C. Selvakumar (*Alternate*) |
| Steel Authority of India Ltd, Bhilai | Shri K. Dharmarajan<br>Shri M. K. Mukherjee (*Alternate*) |
| Tata Engg. & Locomotive Co Ltd, Pune | Shri R. K. Joshi<br>Shri S. Mishra (*Alternate*) |

(*Continued on page* 15)

(*Continued from page* 14)

| *Organization* | *Representative(s)* |
|---|---|
| Tata Iron and Steel Company Limited, Jamshedpur | Shri D. P. Rathore<br>Shri J. P. Singh (*Alternate*) |
| Tractor India Ltd, Kolkata | Shri Srimanta Datta<br>Shri A. K. Halder (*Alternate*) |
| Tractel Tirfor (India) Ltd, New Delhi | Dr P. K. Chakravarty<br>Shri Saurabh Rajouria (*Alternate*) |
| Unicon Technology International Pvt Ltd, New Delhi | Shri R. S. Nalwa<br>Shri Manish Nalwa (*Alternate*) |
| WMI Cranes Ltd, Mumbai | Shri S. M. Malani |
| BIS Directorate General | Shri M. L. Chopra, Director and Head (MED)<br>[Representing Director General (*Ex-officio*)] |

*Member Secretary*
Shri S. B. Roy
Director (MED), BIS

## Bureau of Indian Standards

BIS is a statutory institution established under the *Bureau of Indian Standards Act,* 1986 to promote harmonious development of the activities of standardization, marking and quality certification of goods and attending to connected matters in the country.

## Copyright

BIS has the copyright of all its publications. No part of these publications may be reprodued in any form without the prior permission in writing from BIS. This does not preclude the free use, in the course of implementing the standard, of necessary details, such as symbols and sizes, type or grade designations. Enquiries relating to copyright may be addressed to the Director (Publications), BIS.

## Review of Indian Standards

Amendments are issued to standards as the need arises on the basis of comments. Standards are also reviewed periodically; a standard along with amendments is reaffirmed when such review indicates that no changes are needed; if the review indicates that changes are needed, it is taken up for revision. Users of Indian Standards should ascertain that they are in possession of the latest amendments or edition by referring to the latest issue of 'BIS Catalogue' and 'Standards: Monthly Additions'.

This Indian Standard has been developed from Doc : No. MED 14 (0875).

### Amendments Issued Since Publication

| Amend No. | Date of Issue | Text Affected |
|---|---|---|
| | | |
| | | |
| | | |

BUREAU OF INDIAN STANDARDS

Headquarters :

Manak Bhavan, 9 Bahadur Shah Zafar Marg, New Delhi 110 002
Telephones : 323 01 31, 323 33 75, 323 94 02

Telegrams : Manaksanstha
(Common to all offices)

| Regional Offices : | | Telephone |
|---|---|---|
| Central | : Manak Bhavan, 9 Bahadur Shah Zafar Marg<br>NEW DELHI 110 002 | 323 76 17<br>323 38 41 |
| Eastern | : 1/14 C.I.T. Scheme VI M, V. I. P. Road, Kankurgachi<br>KOLKATA 700 054 | 337 84 99, 337 85 61<br>337 86 26, 337 91 20 |
| Northern | : SCO 335-336, Sector 34-A, CHANDIGARH 160 022 | 60 38 43<br>60 20 25 |
| Southern | : C.I.T. Campus, IV Cross Road, CHENNAI 600 113 | 254 12 16, 254 14 42<br>254 25 19, 254 13 15 |
| Western | : Manakalaya, E9 MIDC, Marol, Andheri (East)<br>MUMBAI 400 093 | 832 92 95, 832 78 58<br>832 78 91, 832 78 92 |

Branches : AHMEDABAD. BANGALORE. BHOPAL. BHUBANESHWAR. COIMBATORE. FARIDABAD. GHAZIABAD. GUWAHATI. HYDERABAD. JAIPUR. KANPUR. LUCKNOW. NAGPUR. NALAGARH. PATNA. PUNE. RAJKOT. THIRUVANANTHAPURAM. VISAKHAPATNAM.

Printed by Dee Kay Printers.